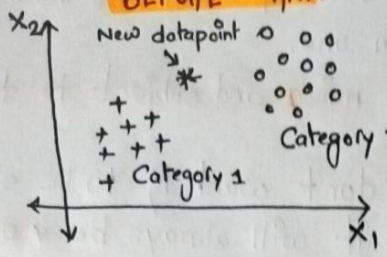
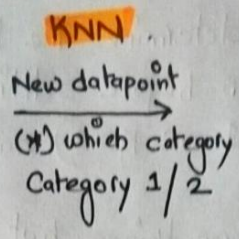
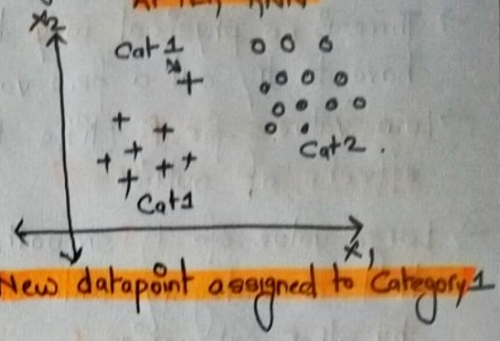
KNN DISTRIBUTION / CLASSIFICATION → K Nearest Neighbour Algorithm (Non parametric)







STEPS TO FOLLOW IN KNN

Step 1 - Choose the number K of neighbours.

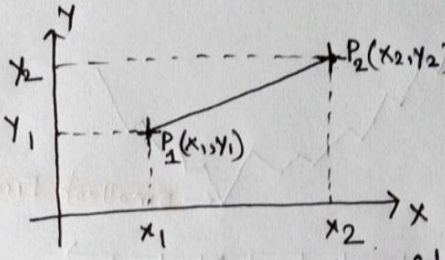
Step 2 - Take the K nearest neighbour of new datapoint, according to the Euclidean distance.

Step 3 - Among the K neighbours, count the number of data point in each category.

Step 4 - Assign the new datapoints to the category where you counted the most neighbour.

Your Model is Ready.

Euclidean Distance →



Euclidean distance between P_1 and P_2 =

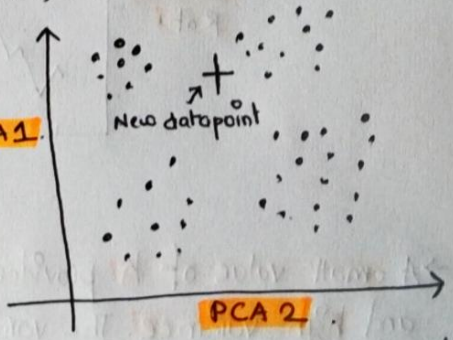
$$\sqrt{(x_2-x_1)^2+(y_2-y_1)^2}$$

Suppose we choose K=5, so according to new data point, new data point consist of 2 categories. Category 1 = 3 + Category 2 = 2 0 So, based on 3+, new data point is assigned to '+' category.

Example → We need to define the cell types → Stem Cells, Blood Vessel Cells, Fat Cells

Step 1 → Start with the dataset with know categories. In this case, we have different cell types from a tumor. Then cluster the data. In this case, we used PCA.

Step 2 → Add a new cell, with unknown category to the PCA plot. We don't know this cell category because it was taken from another tumor. So we need to classify the new unknown cell.



Step 3 → We classify the new cell by looking at the nearest annotated cells (i.e. nearest neighbours)

If K is equal to 1, then we only use the nearest neighbour to define the category.

If K is equal to 11, we would use 11 nearest neighbours and based on majority assign the class.

Based on the most votes, assign the new datapoint to the class having most votes.

NOTE → If K is odd, then we can avoid ties (equal count to each group) and if we still get a tied vote, we can flip a coin / decide not to assign any category.

A FEW THOUGHTS ON PICKING A VALUE OF "K".

→ There is no physical way to determine the best value for "K", so we may have to try out a few values before settling on one.

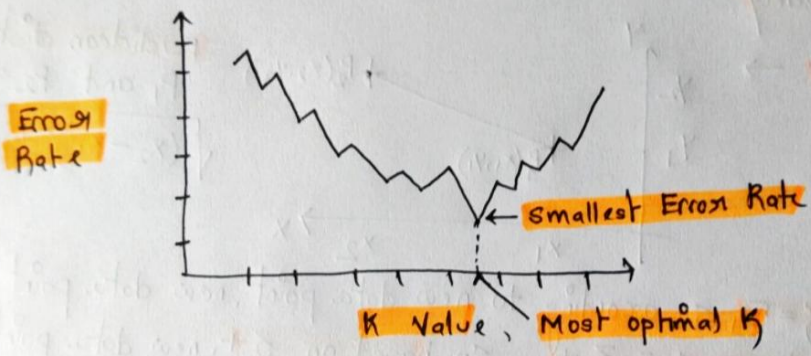
→ Low values for K (like K=1 or K=2) can be noisy and subject to the effects of outliers.

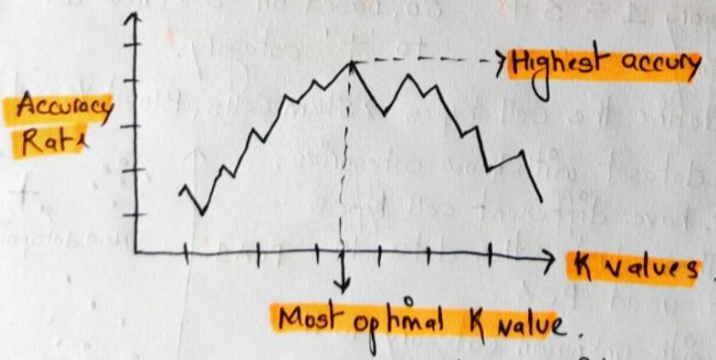
→ Large value of K smooth over things, but we don't want K to be so large that a category with only a few samples in it will always be outvoted by other categories.

→ In general practise, choosing the value of K is K = sqrt(N) where N stands for Number of samples in training dataset.

→ Another way to choose K is through cross-validation. One way to select different possible value of K and check for what value of K gives us the best performance on validation set.

→ Use an error plot or accuracy plot to find the most favourable K value.





→ A small value of K provides the most flexible fit, which will have low bias and high variance. The variance is due to the fact that the prediction in a given region is entirely dependent on just one observation.

→ Large value of K provide a smoother and less variable fit, the prediction in a region is an average of several points and so changing one observation has smaller effects. However smoothing may cause bias. High bias, low variance.